SILICON N-P-N "overlay" TRANSISTOR 2N5071

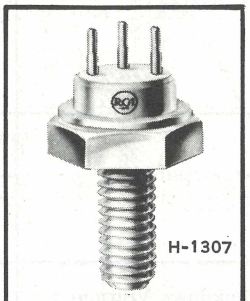
File No. 269

RCA-2N5071* is an epitaxial silicon n-p-n planar transistor of the "overlay" emitter electrode construction. It is intended as a high-power, class B and C rf amplifier for FM communications with a 24-volt power supply. It is useful for both narrowband and wideband applications in the 30 to 76 MHz frequency range.

In the overlay structure, there are a number of individual emitter sites which are all connected in parallel and used in conjunction with a common collector region. When compared with other structures, this arrangement provides a substantial increase in emitter periphery for higher current or power, and a corresponding decrease in emitter and collector areas for lower input and output capacitances. The overlay structure thus offers greater power output, gain, efficiency, frequency capability, and linearity.

The transistor can be operated under a wide range of mismatched load conditions. All transistors are tested for a load mismatch having a VSWR of 3:1 which is varied through all phases. The test is performed at 30 MHz and 30 watts output.

Formerly RCA-Dev. No.TA2827



JEDEC TO-60

- For Class-B or Class-C Amplifiers
- For 24 V FM (30 to 70 MHz) Communications
- 24 Watts Output at 76 MHz with 9 dB Gain (Min.)
- Low Thermal Resistance

RATINGS

Maximum Ratings, *Absolute-Maximum Values:*

COLLECTOR-TO-EMITTER VOLTAGE:			
With V_{BE} = −1.5 V	V_{CEV}	65	V
With external base-to-emitter resistance (R_{BE} = 5 Ω)	V_{CER}	40	V
EMITTER-TO-BASE VOLTAGE	V_{EBO}	4	V
COLLECTOR CURRENT:			
Peak		10	A
Continuous	I_C	3.3	A
TRANSISTOR DISSIPATION	P_T		
At case temperatures up to 25° C		70	W
At case temperatures above 25° C		See *Fig.4*	
TEMPERATURE RANGE:			
Storage & Operating (Junction)		−65 to 200	°C
LEAD TEMPERATURE (During soldering):			
At distances ≥ 1/32 in. from insulating wafer for 10 s max.		230	°C

TYPICAL POWER OUTPUT vs. FREQUENCY

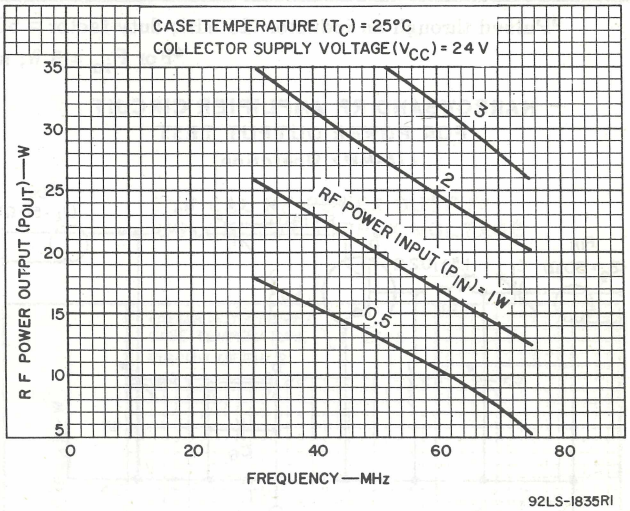


Fig. 1

Information furnished by RCA is believed to be accurate and reliable. However, no responsibility is assumed by RCA for its use; nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of RCA.

RADIO CORPORATION OF AMERICA
ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N.J.

Trademark(s) ® Registered
Marca(s) Registrada(s)

Printed in U.S.A.
5/67

ELECTRICAL CHARACTERISTICS

Case Temperature = 25° C

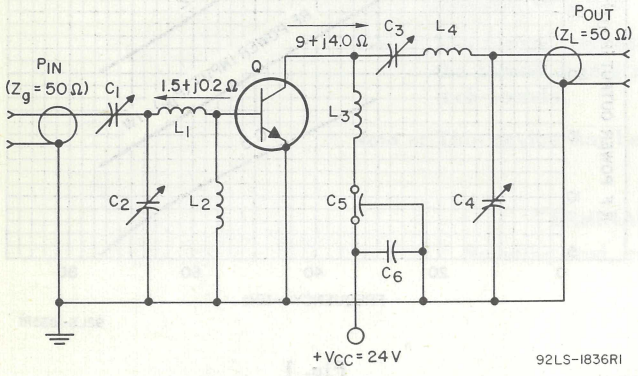
Characteristics	Symbol	TEST CONDITIONS					Limits		Units
		DC Collector Volts		DC Base Volts	DC Current mA				
		V_{CB}	V_{CE}	V_{BE}	I_E	I_C	Min.	Max.	
Collector-to-emitter Sustaining Voltage	$V_{CEV}(sus)$			−1.5		200[a]	65	–	V
	$V_{CER}(sus)$ R_{BE} = 5 Ω					200[a]	40	–	V
Emitter-to-base Breakdown Voltage	BV_{EBO}				10		4	–	V
Collector-to-emitter Cutoff Current	I_{CEO}		30				–	5.0	mA
Collector-to-base Cutoff Current	I_{CBO}	60						10	mA
Collector-to-base Capacitance Measured at 1 MHz	C_{ob}	30					–	85	pF
RF Power Output, Narrowband Amplifier, At 76 MHz (See *Fig.2*)	P_{OUT}		24				24[b]		W
RF Power Output, Wideband Amplifier, At 30 to 76 MHz (See *Fig.3*)	P_{OUT}		24				15[c]		W
Junction-to-case Thermal Resistance	θ_{J-C}							2.5	°C/W

[a]Pulsed through an inductor (25 mH); duty factor = 50%.

[b]For P_{in} = 3 W; minimum efficiency = 60%.

[c]For P_{in} = 3 W; minimum efficiency = 35%.

NARROWBAND RF AMPLIFIER CIRCUIT FOR POWER OUTPUT TEST (76-MHz Operation)

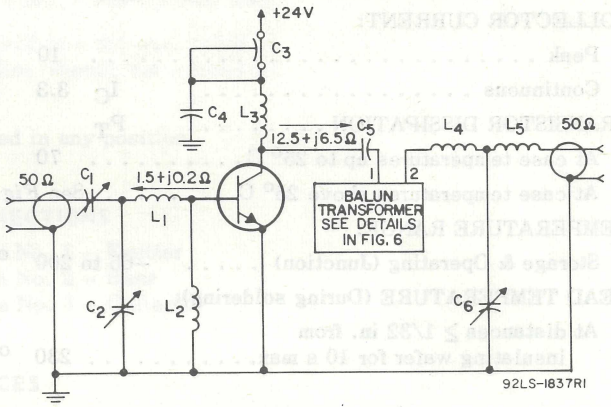


C_1, C_2: 55-300 pF, ARCO 427, or equivalent
C_3, C_4: 32-250 pF, ARCO 426, or equivalent
C_5: 1000 pF
C_6: 0.1 µF (50 V)
L_1: 1 turn, No.16 wire, 5/16" I.D.
L_2: Ferroxcube No.VK200 01-3B, or equivalent
L_3, L_4: 3 turns, No.10 wire, 5/16" I.D., 1/2" long
Q: 2N5071

Fig. 2

Note: Impedance measurements are made at transistor socket pins.

WIDEBAND RF AMPLIFIER CIRCUIT FOR POWER OUTPUT TEST (30 to 76 MHz Operation)



C_1, C_2: 55-300 pF, ARCO 427, or equivalent
C_3: 100 pF
C_4: 0.1 µF (50 V).
C_5: 0.1 µF (5 in parallel), 200 V, Hi Q or equivalent
C_6: 14-150 pF, ARCO 424, or equivalent
L_1: 1 turn, No.16 wire, 5/16" I.D.
L_2: Ferroxcube No.VK200 01-3B, or equivalent
L_3: G.I. CF106 Q1, 10 turns, No.22 wire
L_4, L_5: 5 turns, No.12 wire, 1/2" I.D.
Q: 2N5071

Fig. 3

DISSIPATION DERATING CURVE

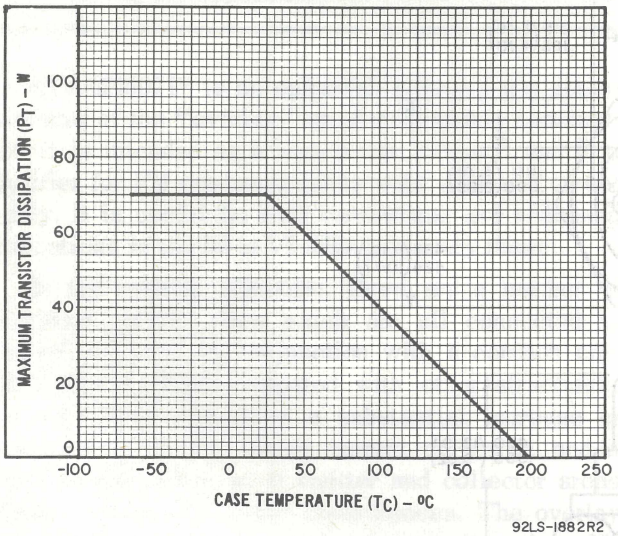


Fig. 4

SAFE OPERATION WITH DC FORWARD BIAS

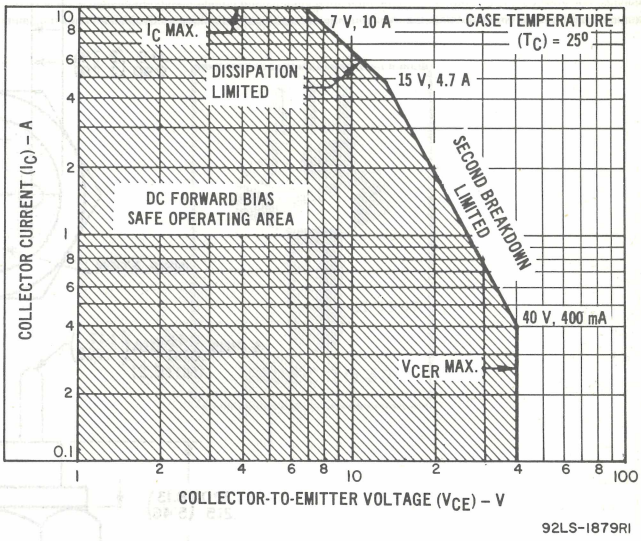
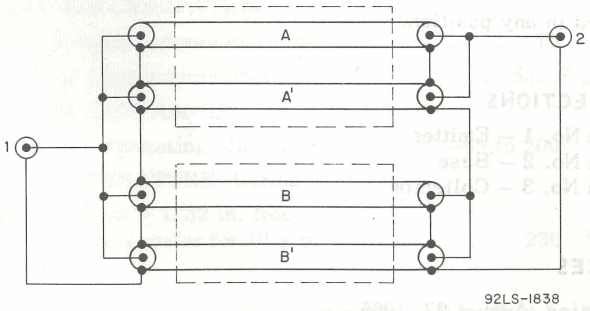


Fig. 5

DETAIL OF BALUN TRANSFORMER CONSTRUCTION



1. Wind A and A' on a G.I. No.CF111, Q1 core, 7 turns. (Use RG196 A/U 50-ohm wire)
2. Wind B and B' on another G.I. No.CF111, Q1 core, 7 turns. (Use RG196 A/U 50-ohm wire)
3. Stack two cores together and connect as shown above.

Fig. 6

TYPICAL RF POWER OUTPUT vs. COLLECTOR SUPPLY VOLTAGE

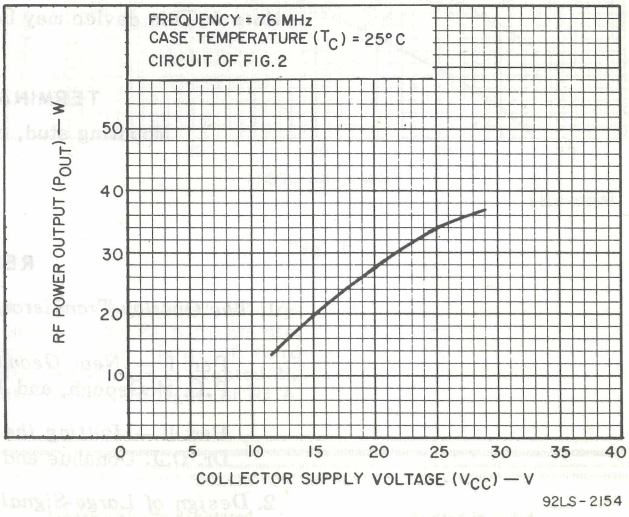
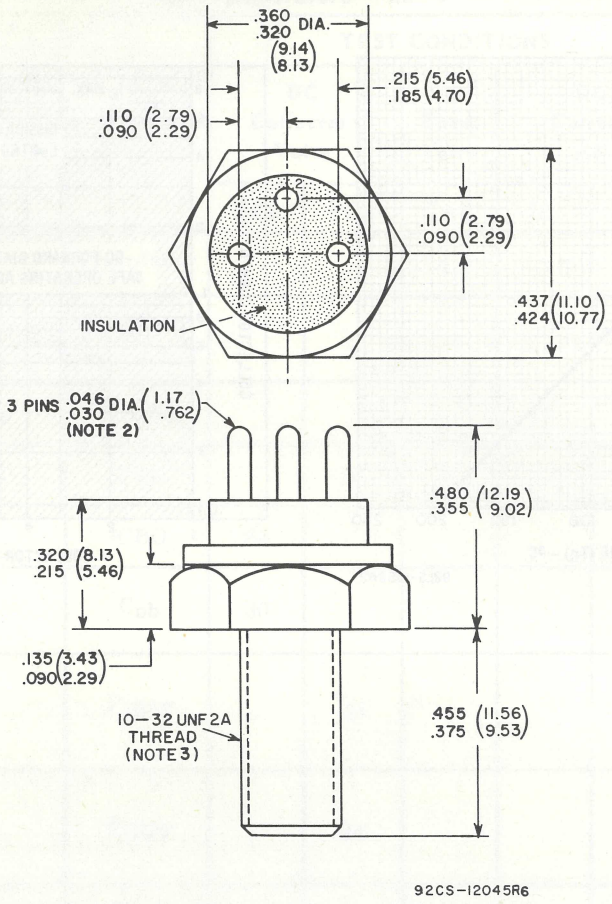


Fig. 7

DIMENSIONAL OUTLINE
JEDEC TO-60



92CS-12045R6

DIMENSIONS IN INCHES AND MILLIMETERS

Note 1: *Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated.*

Note 2: The pin spacing permits insertion in any socket having a pin-circle diameter of 0.200" (5.08) and contacts which will accommodate pins having a diameter of 0.035" (0.889) min., 0.045" (1.143) max.

Note 3: The torque applied to a 10-32 hex nut assembled on the thread during installation should not exceed 12 inch-pounds.

Note 4: This device may be operated in any position.

TERMINAL CONNECTIONS

Mounting stud, case, Pin No. 1 – Emitter
Pin No. 2 – Base
Pin No. 3 – Collector

REFERENCES

1. *The Overlay Transistor,* Electronics, August 23, 1965.

Part I – *New Geometry Boosts Power,* D.R. Carley, P.L. McGeough, and J.F. O'Brien.

Part II – *Putting the Overlay to Work at Hi-Frequency.* Dr. D.J. Donahue and B.A. Jacoby.

2. *Design of Large-Signal VHF Transistor Power Amplifiers,* R. Minton, RCA Application Note SMA-36.